

CLAIMS

1. A multi-element antenna wireless communication method comprising:

selecting a subset of active antennas from a plurality of available antennas in an multi-element antenna system based on higher-order statistics of a propagation medium.

2. The method of claim 1, wherein the higher-order statistics comprise second-order statistics of the propagation medium.

3. The method of claim 1, further comprising selecting a constellation for transmission on the active antennas.

4. The method of claim 3, wherein said selecting the constellation for transmission on the active antennas comprises selecting different constellations for two or more of the active antennas.

5. The method of claim 1, wherein the multi-element antenna system comprises a multiple-in multiple-out (MIMO) system.

6. The method of claim 1, wherein said selecting comprises selecting the subset of active antennas based on correlation matrices among the active antennas..

7. The method of claim 1, wherein said selecting comprises selecting an optimum number of antennas to maximize a minimum signal-to-noise ratio (SNR) margin.

8. The method of claim 1, wherein said selecting comprises selecting the subset of active antennas based on a fixed data rate.

9. The method of claim 1, wherein said selecting comprises determining a subset including M_T active transmit antennas by solving for the equation

$$(M_T, p) = \arg \max_{(\tilde{M}_T, \tilde{p})} \frac{\lambda \min(R_T(\tilde{M}_T, \tilde{p}))}{\tilde{M}_T(2^{b_T/\tilde{M}_T} - 1)} \cdot \bar{\lambda}_{\min}(H_w^*(K_R, \tilde{M}_T) H_w(K_R, \tilde{M}_T)).$$

10. The method of claim 1, further comprising allocating substantially equal power to each of said active antennas.

11. The method of claim 1, wherein said selecting comprises determining a subset including M_T active transmit

antennas by solving for the equation

$$(M_r, p) = \arg \max_{(\tilde{M}_r, \tilde{p})} \left\{ \frac{1}{\tilde{M}_r} \left[\ln \det(R_r(\tilde{M}_r, \tilde{p})) + \sum_{j=1}^{\tilde{M}_r} \sum_{i=1}^{K_R-j} \frac{1}{i} - b_r \ln 2 \right] - \ln \tilde{M}_r \right\}.$$

12. An apparatus comprising:

a processor operative to select a subset of active antennas from a plurality of available antennas based on higher-order statistics of a propagation medium.

13. The apparatus of claim 12, wherein the higher-order statistics comprise second-order statistics of the propagation medium.

14. The apparatus of claim 12, wherein the processor is operative to select a constellation for transmission on the active antennas.

15. The apparatus of claim 14, wherein the processor is operative to select different constellations for two or more of the active antennas.

16. The apparatus of claim 12, wherein the apparatus comprises at least a portion of a multiple-in multiple-out (MIMO) device.

17. The apparatus of claim 12, wherein the processor is operative to select the subset of active antennas based on correlation matrices among the active antennas.

18. The apparatus of claim 12, the processor is operative to select an optimum number of antennas to maximize a minimum signal-to-noise ratio (SNR) margin.

19. The apparatus of claim 12, the processor is operative to select the subset of active antennas based on a fixed data rate.

20. The apparatus of claim 12, the processor is operative to select a subset including M_T active transmit antennas by solving for the equation

$$(M_T, p) = \arg \max_{(\tilde{M}_T, \tilde{p})} \frac{\lambda \min(R_T(\tilde{M}_T, \tilde{p}))}{\tilde{M}_T(2^{b_T/\tilde{M}_T} - 1)} \cdot \bar{\lambda}_{\min}(H_w^*(K_R, \tilde{M}_T) H_w(K_R, \tilde{M}_T)).$$

21. The apparatus of claim 12, the processor is operative to allocate substantially equal power to each of said active antennas.

22. The apparatus of claim 12, the processor is operative to select a subset including M_T active transmit

antennas by solving for the equation

$$(M_r, p) = \arg \max_{(\tilde{M}_r, \tilde{p})} \left\{ \frac{1}{\tilde{M}_r} \left[\ln \det(R_r(\tilde{M}_r, \tilde{p})) + \sum_{j=1}^{\tilde{M}_r} \sum_{i=1}^{K_R - j} \frac{1}{i} - b_r \ln 2 \right] - \ln \tilde{M}_r \right\}.$$

23. An apparatus comprising:

a processor including means for selecting a subset of active antennas from a plurality of available antennas based on higher-order statistics of a propagation medium.

24. The apparatus of claim 23, wherein the higher-order statistics comprise second-order statistics of the propagation medium.

25. The apparatus of claim 23, further comprising means for selecting a constellation for transmission on the active antennas.

26. The apparatus of claim 25, further comprising means for selecting different constellations for two or more of the active antennas.

27. The apparatus of claim 23, wherein the apparatus comprises at least a portion of a multiple-in multiple-out (MIMO) device.

28. The apparatus of claim 23, further comprising means for selecting the subset of active antennas based on correlation matrices among the active antennas.

29. The apparatus of claim 23, wherein said selecting comprises selecting an optimum number of antennas to maximize a minimum signal-to-noise ratio (SNR) margin.

30. The apparatus of claim 23, further comprising means for selecting the subset of active antennas based on a fixed data rate.

31. The apparatus of claim 23, further comprising means for determining a subset including M_T active transmit antennas by solving for the equation

$$(M_T, p) = \arg \max_{(\tilde{M}_T, \tilde{p})} \frac{\lambda \min(R_T(\tilde{M}_T, \tilde{p}))}{\tilde{M}_T(2^{b_T/\tilde{M}_T} - 1)} \cdot \bar{\lambda}_{\min}(H_w^*(K_R, \tilde{M}_T) H_w(K_R, \tilde{M}_T)).$$

32. The apparatus of claim 23, further comprising means for allocating substantially equal power to each of said active antennas.

33. The apparatus of claim 23, further comprising means for determining a subset including M_T active transmit

antennas by solving for the equation

$$(M_r, p) = \arg \max_{(\tilde{M}_r, \tilde{p})} \left\{ \frac{1}{\tilde{M}_r} \left[\ln \det(R_r(\tilde{M}_r, \tilde{p})) + \sum_{j=1}^{\tilde{M}_r} \sum_{i=1}^{K_{R,j}} \frac{1}{i} - b_r \ln 2 \right] - \ln \tilde{M}_r \right\}.$$

34. A system comprising:

a propagation medium;

a first transceiver including a plurality of available antennas;

a second transceiver including

a plurality of available antennas

a processor operative to determine second-order statistics of the propagation medium from signals received from the plurality of available antennas at the first transceiver; and

an antenna selection module operative to select a subset of active antennas from the plurality of available antennas based on second-order statistics of a propagation medium.

35. The system of claim 34, wherein the higher-order statistics comprise second-order statistics of the propagation medium.

36. The system of claim 34, wherein the processor is operative to select a constellation for transmission on the active antennas.

37. The system of claim 36, wherein the processor is operative to select different constellations for two or more of the active antennas.

38. The system of claim 34, wherein the system comprises at least a portion of a multiple-in multiple-out (MIMO) device.

39. The system of claim 34, wherein the processor is operative to select the subset of active antennas based on correlation matrices among the active antennas.

40. The system of claim 34, the processor is operative to select an optimum number of antennas to maximize a minimum signal-to-noise ratio (SNR) margin.

41. The system of claim 34, the processor is operative to select the subset of active antennas based on a fixed data rate.

42. The system of claim 34, the processor is operative to select a subset including M_T active transmit antennas by solving for the equation

$$(M_r, p) = \arg \max_{(\tilde{M}_r, \tilde{p})} \frac{\lambda \min(R_r(\tilde{M}_r, \tilde{p}))}{\tilde{M}_r(2^{b_r/\tilde{M}_r} - 1)} \cdot \bar{\lambda}_{\min}(H_w(K_R, \tilde{M}_r) H_w(K_R, \tilde{M}_T)).$$

43. The system of claim 34, the processor is operative to allocate substantially equal power to each of said active antennas.

44. The system of claim 34, the processor is operative to select a subset including M_T active transmit antennas by solving for the equation

$$(M_r, p) = \arg \max_{(\tilde{M}_r, \tilde{p})} \left\{ \frac{1}{\tilde{M}_r} \left[\ln \det(R_r(\tilde{M}_r, \tilde{p})) + \sum_{j=1}^{\tilde{M}_r} \sum_{i=1}^{K_R-j} \frac{1}{i} - b_r \ln 2 \right] - \ln \tilde{M}_r \right\}.$$

45. A computer program comprising the steps of:
 selecting a subset of active antennas from a plurality of available antennas in an multi-element antenna system based on higher-order statistics of a propagation medium.

46. The computer program of claim 45, wherein the higher-order statistics comprise second-order statistics of the propagation medium.

47. The computer program of claim 45, further comprising selecting a constellation for transmission on the active antennas.

48. The computer program of claim 47, wherein said selecting the constellation for transmission on the active antennas comprises selecting different constellations for two or more of the active antennas.

49. The computer program of claim 45, wherein the multi-element antenna system comprises a multiple-in multiple-out (MIMO) system.

50. The computer program of claim 45, wherein said selecting comprises selecting the subset of active antennas based on correlation matrices among the active antennas.

51. The computer program of claim 45, wherein said selecting comprises selecting an optimum number of antennas to maximize a minimum signal-to-noise ratio (SNR) margin.

52. The computer program of claim 45, wherein said selecting comprises selecting the subset of active antennas based on a fixed data rate.

53. The computer program of claim 45, wherein said selecting comprises determining a subset including M_T active transmit antennas by solving for the equation

$$(M_T, p) = \arg \max_{(\tilde{M}_T, \tilde{p})} \frac{\lambda \min(R_T(\tilde{M}_T, \tilde{p}))}{\tilde{M}_T (2^{b_T/\tilde{M}_T} - 1)} \cdot \bar{\lambda}_{\min}(H_w^*(K_R, \tilde{M}_T) H_w(K_R, \tilde{M}_T)).$$

54. The computer program of claim 45, further comprising generating a signal operative to allocate substantially equal power to each of said active antennas.

55. The computer program of claim 45, wherein said selecting comprises determining a subset including M_T active transmit antennas by solving for the equation

$$(M_T, p) = \arg \max_{(\tilde{M}_T, \tilde{p})} \left\{ \frac{1}{\tilde{M}_T} \left[\ln \det(R_T(\tilde{M}_T, \tilde{p})) + \sum_{j=1}^{\tilde{M}_T} \sum_{i=1}^{K_R-j} \frac{1}{i} - b_T \ln 2 \right] - \ln \tilde{M}_T \right\}.$$